

## VDOT Tunnel Facilities Action Plan

The report prepared by Earth Tech, Inc., entitled *Programmatic Review of Critical Fire Life Safety Systems and Procedures*, assessed the current state of Fire Life Safety and Fire Protection (FLS & FP) systems for the following VDOT tunnels:

- Hampton Roads Bridge Tunnels (HRBT)
- Elizabeth River Tunnel Downtown (ERT (DT))
- Elizabeth River Tunnel Midtown (ERT (MT))
- Monitor Merrimac Memorial Tunnel (MMMT)
- Big Walker Mountain Tunnel (BWMT)
- East River Mountain Tunnel (ERMT)

In response to the Earth Tech report dated February 9, 2004, VDOT plans to take the follow action to implement the report.

### FINANCIAL SUMMARY

VDOT is proposing to spend \$62.162 million through fiscal year 2009 to upgrade its tunnels to bring them into compliance with NFPA 502. In reviewing the Earth Tech report, it was determined that VDOT has completed or is in the process of completing millions of dollars of upgrades that will meet the requirements of NFPA 502. The cost of the remaining upgrades is projected over five fiscal years.

- \$6.342 million of upgrades have already been completed, are underway or will be under contract by July 1, 2004. These upgrades have identified funding sources.
- Structural repairs in the two mountain tunnels are so intertwined with the work required for the FLS & FP systems that these repairs are included in this total. In the Six Year Plan, \$4.314 million has been identified for the upgrades to the mountain tunnels.
- Funding sources are not identified for the balance of \$51.776 million in upgrades.

The Hampton Roads District will spend \$29.874 million on its tunnels. The Bristol District will spend \$32.288 million on the two mountain tunnels.

### Spending By Fiscal Year (in millions)

	FY04	FY05 Year 1	FY06 Year 2	FY07 Year 3	FY08 Year 4	FY09 Year 5	Total (By tunnel)
HRBT	0.372	5.670	0.810	-0-	-0-	4.000	10.852
ERT (DT)	0.435	0.435	2.120	1.600	-0-	0.900	5.490
ERT (MT)	0.020	2.412	3.720	0.200	-0-	-0-	6.352
MMMT	4.200	1.110	0.820	1.050	-0-	-0-	7.180
BWMT & ERMT	1.315	3.733	4.222	7.590	8.932	6.496	32.288
Total (By Year)	6.342	13.360	11.692	10.440	8.932	11.396	62.162

## **WORK SUMMARY**

This section contains a summary of the work proposed for each tunnel. The Earth Tech report listed the areas in need of compliance by individual components of a Fire Life Safety and Fire Protection (FLS & FP) system (i.e. Traffic Control, Fire Suppression, etc.).

Within these components, Earth Tech listed subcomponents of a FLS & FP system and, using a color-coding system, put each component into three categories of compliance or non-compliance with NFPA 502. These categories are:

**Required:** Upgrades are required by NFPA 502 to be in compliance, generally operational procedures or plans.

**Required Retroactively:** The AHJ will determine if upgrades are necessary or if alternatives or existing systems clearly provide a reasonable degree of safety. Generally structural or equipment upgrades.

**Not Required But Relevant:** Upgrades are not required by NFPA 502 but are recommended in order to have a comprehensive FLS & FP system.

The two district offices are proposing upgrades that will provide a comprehensive FLS & FP system at all VDOT tunnels. The district's proposals will complete all operational and procedure requirements to be in full compliance with NFPA 502. In addition, structural and equipment upgrades are proposed where practical. Where it is not practical to upgrade structures or equipment, the districts have proposed alternatives or descriptions of existing systems that provide a reasonable degree of safety, in accordance with NFPA 502. The districts have also proposed work recommended but not required by NFPA 502 in order to provide a comprehensive FLS & FP system.

## **HAMPTON ROADS DISTRICT**

The Hampton Roads District is proposing \$29.874 million in upgrades to comply with NFPA 502. \$5.027 million in work has either been completed previously and was not included in the Earth Tech report or will be under contract by July 1, 2004. The upgrades are listed by component of the FLS & FP system as contained in the Earth Tech report.

### **Structural Rehabilitation**

- **Hampton Roads Bridge Tunnel:** No work recommended or proposed.
- **Elizabeth River Tunnel (Downtown):** No work recommended or proposed.
- **Elizabeth River Tunnel (Midtown):** No work recommended or proposed.
- **Monitor Merrimac Memorial Tunnel:** No work recommended or proposed.

### **Traffic Control**

- **Hampton Roads Bridge Tunnel:** All systems meet NFPA 502 standards.
- **Elizabeth River Tunnel (Downtown):** All systems meet NFPA 502 standards.
- **Elizabeth River Tunnel (Midtown):** Install automated traffic signal and vehicle detection system with two VMS signs by FY06.
- **Monitor Merrimac Memorial Tunnel:** All systems meet NFPA 502 standards.

### **Fire Suppression**

- **Hampton Roads Bridge Tunnel:** Valves and hydrants, and the standpipe and water supply system scheduled for repair. To be complete by the end of calendar 2005.
- **Elizabeth River Tunnel (Downtown):** Main supply line tested and back in service March 2003. Westbound Lane (WBL) valve rehabilitation contract in procurement, estimated completion date FY05. Standpipe repairs already completed, one standpipe embedded in tunnel road still in need of repair, estimated completion FY05.
- **Elizabeth River Tunnel (Midtown):** One standpipe is scheduled for repair in FY05.
- **Monitor Merrimac Memorial Tunnel:** Contract for new water line underway and estimated completion date is June 2004.

### **Ventilation**

- **Hampton Roads Bridge Tunnel:** Fire emergency plan and operational procedures presently in place but will be updated pending recommendations of Fire Engineering Analysis. Scope of work for damper repair in development with completion date of December 2004.
- **Elizabeth River Tunnel (Downtown):** Fire emergency plan and operational procedures presently in place but will be updated pending recommendations of Fire Engineering Analysis. Fans and dampers to be upgraded based on Fire Engineering Analysis.
- **Elizabeth River Tunnel (Midtown):** Fire emergency plan and operational procedures presently in place but will be updated pending recommendations of Fire Engineering Analysis. Secondary power improvements scheduled for FY05.
- **Monitor Merrimac Memorial Tunnel:** Fire emergency plan and operational procedures presently in place but will be updated pending recommendations of Fire

Engineering Analysis. Fans and dampers to be upgraded based on Fire Engineering Analysis with estimated completion date of May 2006.

### **Tunnel Lighting**

- **Hampton Roads Bridge Tunnel:** Westbound Lane (WBL) emergency lighting repair underway with completion date of May 2004. WBL lighting repairs also underway with state forces. Eastbound Lane (EBL) emergency and standard lighting systems repair not yet scheduled but estimated to cost \$4.0 million.
- **Elizabeth River Tunnel (Downtown):** Interim emergency lighting repairs underway and upgrade of emergency lighting system estimated to be complete in FY07.
- **Elizabeth River Tunnel (Midtown):** Interim emergency lighting repairs underway and upgrade of emergency lighting system estimated to be complete in FY07.
- **Monitor Merrimac Memorial Tunnel:** Emergency lighting system to be upgraded with completion in 2007.

### **Power**

- **Hampton Roads Bridge Tunnel:** Upgrade necessary if ventilation and lighting are upgraded pending the Engineering Analysis.
- **Elizabeth River Tunnel (Downtown):** Generator upgrades to support secondary power to be complete in FY07.
- **Elizabeth River Tunnel (Midtown):** Secondary power is sufficient. Upgrades necessary only if Fire Engineering Analysis recommends ventilation system upgrades.
- **Monitor Merrimac Memorial Tunnel:** Limited upgrades to primary and secondary power necessary.

### **Communications**

- **Hampton Roads Bridge Tunnel:** All systems meet NFPA 502 standards.
- **Elizabeth River Tunnel (Downtown):** All systems meet NFPA 502 standards.
- **Elizabeth River Tunnel (Midtown):** Tunnel Radio Rebroadcast System to be upgraded with completion in FY05.
- **Monitor Merrimac Memorial Tunnel:** All systems meet NFPA 502 standards.

### **Tunnel Drainage**

- **Hampton Roads Bridge Tunnel:** Floodgate repair contract advertised with completion date of August 2004. Drainage pumps to be repaired by VDOT forces with completion date of August 2005.
- **Elizabeth River Tunnel (Downtown):** All systems reviewed by Earth Tech meet NFPA 502 standards. Comments indicated water intrusion points in conduits to be sealed. VDOT staff performing work with completion in April 2004.
- **Elizabeth River Tunnel (Midtown):** All systems meet NFPA 502 standards.
- **Monitor Merrimac Memorial Tunnel:** All systems meet NFPA 502 standards.

### **Materials**

- **Hampton Roads Bridge Tunnel:** All future conduits to be NFPA compliant. Critical systems not affected with present status.

- **Elizabeth River Tunnel (Downtown):** All future conduits to be NFPA compliant. Critical systems not affected with present status.
- **Elizabeth River Tunnel (Midtown):** All future conduits to be NFPA compliant. Critical systems not affected with present status.
- **Monitor Merrimac Memorial Tunnel:** Upgrades to conduits to be complete by September 2004.

## **Maintenance**

- **All Tunnels:** Internal policies and procedures will be reviewed and updated for exercises and drills for preventive maintenance operations, which will begin in April 2004 and be carried out at least two times per year.

## **Emergency Response**

**All Tunnels:** Emergency response has been prepared for all tunnels. This plan has been submitted to Earth Tech for review.

## **Emergency Egress**

- **Hampton Roads Bridge Tunnel:** A contract for upgrades to emergency walkways being developed. Funding scheduled for FY05.
- **Elizabeth River Tunnel (Downtown):** Walkways are to be reviewed and upgrades will be determined if necessary.
- **Elizabeth River Tunnel (Midtown):** Walkways are to be reviewed and upgrades will be determined if necessary.
- **Monitor Merrimac Memorial Tunnel:** All emergency egress systems meet NFPA 502 standards.

## **BRISTOL DISTRICT**

The Bristol District is proposing \$32.228 million worth of upgrades to comply with NFPA 502. \$1.315 million of the work proposed by the Bristol District will be completed prior to July 1, 2004. The upgrades are listed by component of the FLS & FP system as contained in the Earth Tech report. Unless otherwise noted, all proposed work is for both the Big Walker Mountain Tunnel (BWMT) and the East River Mountain Tunnel (ERMT).

### **Traffic Control**

- **Signals to clear downstream traffic**

This project will be completed by July 1, 2004. This work will upgrade the signal systems in the tunnels to stop traffic from entering in case of a fire emergency and to direct traffic out of the tunnel simultaneously. Signal head replacement material for existing tunnel portal lights for both tunnels will be purchased by July 1, 2004. There are 24 signal heads in ERMT and 36 signal heads in BWMT.

- **Portable Message Boards**

These will be purchased before July 1, 2004 with existing maintenance funding. These will be utilized to control traffic during accidents until permanent variable message signs are in place.

- **Four Fixed Message Signs**

These will be purchased with existing maintenance funds prior to July 1, 2004. These signs will be installed on the face of the tunnel portals.

- **Fixed Message Signs on I-77 & I-81**

These signs will be financed over the next five years. Design and planning will start in year three with construction beginning in year four. These will be placed to control traffic well in advance of the tunnel in case of a fire emergency. Four fixed message signs will also be placed on the face of the tunnel portals in conjunction with the installation of the fixed signs on I-77 and I-81.

- **PTZ Cameras**

PTZ cameras will replace existing traffic monitoring system in the ERMT. These cameras will pan, tilt, and zoom to assist controllers in monitoring and assisting in tunnel operations. These cameras will be purchased in FY09.

### **Fire Suppression**

- **Standpipe/Fire Hose & Water Supply**

Due to its location, it is not practical that local water will ever be available at BWMT. However, at BWMT two 30,000 gallon under-ground tanks will be purchased and installed. The tanks and pertinent materials will be purchased prior to July 1, 2004. The labor for installation will be financed in year one.

- **Other Fire Apparatus**

The Earth Tech report recommended the establishment of a VDOT Fire Brigade for each tunnel. As a practical alternative, the Bristol District is proposing to work with the local, full-time fire departments in nearby West Virginia communities, as well as working with

local volunteer fire departments in Virginia to enhance capabilities. As has been done in the past, VDOT can purchase fire trucks and other equipment via grants in exchange for fire department support or to enhance capabilities.

## **Ventilation**

- **Written Fire Emergency Operation Plan Based on Study**

A written plan presently exists. However, upon completion of the Fire Engineering Analysis, the Tunnel Facility managers will amend the existing plan to incorporate the appropriate recommendations.

- **Operational Procedures**

Standard operational procedures are in place and are based on historic analysis and research. However, upon completion of the Fire Engineering Analysis, the Tunnel Facility managers will amend the existing procedures to incorporate the appropriate recommendations.

- **Purchase Four Truck Mounted Fans & Two Storage Garages**

These trucks are to be purchased in year two and financed over the next two years. Also two garages will have to be installed at BWMT for protection of the vehicles. The purchase of these four fans will bring the two tunnels into compliance with NFPA 502 without the need to purchase 48 new fans. (See item immediately below under Fans).

- **Fans**

This \$1.118 million item is for the purchase of 48 new fans for both tunnels. With 24 fans at each tunnel 6 fans could be updated at each tunnel per year. This would allow quadrants to be completed together. The purchase of the four truck mounted fans listed above brings the two tunnels into compliance with NFPA 502. This purchase assumes the Fire Engineering Analysis will conclude that the existing fans will need to be replaced. Expenditure for this item will be depend upon the conclusions of the Fire Engineering Analysis and may not be necessary.

- **Fire Engineering Analysis**

This analysis should begin immediately and will be financed in year one. Where noted, items for upgrade hinge on the completion and conclusions of this analysis.

- **Manual Override/Bypass PLC Controller**

This item will be financed in year one with design completed in the same year and installation in year two. This provides a second point of operation if communications lines are damaged with the tunnels.

- **Fan Motor Reconditioning at BWMT**

This work is to be paid for with existing maintenance funds by July 1, 2004. This project is about to be awarded to a contractor. This will remove and re-build fan motors to ensure operation during critical times. These motors are old and require a lot of maintenance.

- **Fan Control Starter – Testing and Repair**

This item is to be paid for with exiting maintenance funds by July 1, 2004. These starters have not been overhauled since installation and this will insure they operate properly during critical situations.

- **Damper Doors**

The damper doors are efficient at this time. However the study revealed that they needed to be upgraded. This item will be financed over a three-year period. There are 24 doors

at each tunnel. These could begin to be replaced in year three and completed by year five.

## **Tunnel Lighting**

- **Emergency Lighting**

With total loss of power there is no light in the tunnels for evacuation from inside. This will supply battery backup for select lights to provide sufficient lighting for egress from the tunnel portal. This item is financed over a five-year period.

## **Power**

- **Reliable Primary Distribution**

This item is financed over a three-year period and will provide another sub-station for additional power for the tunnels if the lights and fans are to be upgraded as a result of the Fire Engineering Analysis.

- **Reliable Secondary Distribution**

This item is financed over a five-year period and would pay for upgrades of secondary power supplies to support the new load required by the upgrades as a result of the Fire Engineering Analysis.

- **Re-Condition Breakers and Switch Gears**

Switch gear on the sub-stations need to be re-conditioned to insure operation of tunnel systems. This item is financed within existing maintenance funds and will be complete by July 1, 2004.

## **Materials**

- **Fire Ratings for Electrical Systems**

This would be the fireproofing of existing conduit and wire protection in exhaust air ducts. Design should begin in year two and construction in year three.

## **Maintenance**

- **Routine and Preventive Maintenance**

Routine and Preventive Maintenance Plans are in effect but are only implemented sporadically. The Bristol District Office is presently implementing a plan to hire temporary contract workers to fully implement these existing plans.